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Recent snow cover and temperature variability in the Italian Alps and relations to avalanche activity

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The historical record of snow duration (from 1950 to 2009), snowfall (from 1960 to 2009) and of temperatures collected in the Italian Alps are presented and analysed. A reduction of the snow cover duration and of the snowfall stronger in springtime was detected during the last 40 years with the greatest decreasing rate during the 1990s. The last decade is characterised by a recovery from the documented decreasing trend mainly evident between 800 m and 1500 m. Principal component trend analysis of the snow duration and of the snowfall showed a long term decreasing trend. The change point test showed the existence of breakpoints between 1984 and 1994 that characterise the snow duration and snowfall time series analysed by elevation range and by seasons. These breakpoints mark a drastic trend variability in the time series: a positive trend characterises the time series before the breakpoint and a decreasing trend characterises the historical record after the breakpoint. The described negative trends result from the documented decrease in winter and spring precipitation. This in turn may either relate to a change in fraction of liquid to solid precipitation, and/or be associated to an increase of the temperatures. Northern Hemisphere and Italian Alps snow cover trends strongly correlate in the frequency domain. Among the dominant frequencies the 11.2 period was detected that may relate to the 11-year solar activity cycle. Analysis of the temperature record showed similar trend. Comparison of snow duration and temperatures during springtime (March-April) showed a strong linear correlation (significance level 0.001). This study will contribute to better understand the spring avalanche activity in the investigated region.